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DISTINCTIVE "CONGRID TYPE" FISH OTOLITHS FROM THE LOWER TERTIARY OF THE GULF COAST (PISCES: ANGUILLIFORMES)[1]

by

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Introduction

"Congrid type" sagittae characterize some Recent, presumably anguilliform, fishes (Frost, 1926) and range as fossils at least from the lower Eocene. They show genetic unity in the groups containing them, although relationships even at the ordinal level have not been satisfactorily established.

Two nominal species in the Gulf Coast Tertiary are known from otoliths of this type: "*Congermuraena*" *sector* (Koken) (1888, pp. 292–293, pl. 17, figs. 14–16; as *Otolithus (Platessae)*) and "*Conger*" *brevior* (Koken) (1888, pp. 293–294, pl. 18, fig. 7; as *O. (Congeris)*). "*Congermuraena*" *sector*, described as ranging from Claiborne Eocene to Vicksburg Oligocene, includes a complex of species that will be treated in a later paper. "*Conger*" *brevior*, described from the Jackson Eocene of Jackson, Mississippi, is redescribed from suites of well preserved specimens from Eocene and Oligocene strata of Mississippi and Alabama.

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Five new species are proposed here, from Eocene-Oligocene beds of the Gulf Coast, in order to make names available for these fossils. All are referred to the very broadly based form-genus *"Conger,"* although only one *(C.? vetustus)* shows a close resemblance to otoliths of the Recent genus *Conger* Schaeffer. At least three genera are represented by the described species, but comparative material now available does not justify an attempt at generic allocation.

Acknowledgments

Assistance in various phases of research on fossil fish otoliths has been acknowledged in an earlier paper (Frizzell and Lamber, 1961). To that list we would add: Mr. Emmett Adams, Jackson, Mississippi, who accompanied Frizzell to the Moody's Branch outcrop in Jackson; Mr. C. O. Ketler, Hiwannee, Mississippi, for locality information; Miss Winnie McGlamery, formerly of the Alabama Geological Survey, for data on collecting localities; and Messrs. J. G. McVay and J. A. McClinton, Lone Star Cement Corporation, St. Stephens, Alabama, who made it possible to collect at the St. Stephens quarry.

Morphology of Congrid Type Sagitta

The congrid type sagitta (figure A) has a typically ovate outline, highest toward the anterior and lowest at the posterior end, with dorsal dome (D) developed in some forms. The sulcus is not divided, although caudal and ostial regions (CR and OR) are recognized. An anterior border (AB) separates the ostial region from the anterior margin, and a characteristic ostial channel (OC) opens onto the dorsal margin or anterodorsal slope.

Collecting Localities

The otoliths described here were found in samples from the following localities:

OLIGOCENE, Vicksburg group.

Byram marl. Old Byram, Hinds County, Mississippi (type locality); bank of Pearl River below suspension bridge; irregular beds of shell drift within sandy shell marl of formation. Collectors: D. L. Frizzell, August 31, 1957; D. L. and H. E. Frizzell, August 21, 1959; C K. Lamber, November 26, 1959. (Stations F–57–5; F–59–1C; CKL–59–8, 9.)

Vicksburg, Warren County, Mississippi; small road cut on gravel road adjacent to north boundary of National Cemetery, ca. 30 yards east of U.S. Highway 61; highly glauconitic, indurated shell marl containing stringers of non-indurated broken shell material. Collector: C K. Lamber, November 27, 1959. (Station CKL–59–16.)

Glendon limestone. Quarry of Marquette Cement Company, about one mile southwest of Brandon, Rankin County, Mississippi; glauconitic shell marl above basal limestone stratum of formation; various places within quarry limits. Collectors: D. L. Frizzell, November 26, 1959; C K. Lamber, November 26, 1959. (Stations F–59–13, 15; CKL–59–3, 4, 7.)

Mint Spring marl. National Cemetery, Vicksburg, Warren County, Mississippi (type locality); falls of Mint Spring Bayou at south boundary of cemetery; fossiliferous shell detritus about 1½ feet above basal contact (with Forest Hills formation). Collectors: D. L. Frizzell, November 23, 1959; C. K. Lamber, November 27, 1959. (Stations F–59–6, 7, 8; CKL–59–12, 13.)

Red Bluff clay. Hiwannee (formerly Red Bluff), Wayne County, Mississippi (type locality); bank of Chickasawhay River; shell marl pockets in plastic green clay near low water level. Collectors: D. L. Frizzell and A. R. Troell, Jr., August 4, 1960. (Station F–60–11.)

Red Bluff equivalent. Quarry of Lone Star Cement Corporation, ca. 2 miles northeast of town of St. Stephens, Washington County, Alabama; greenish to white glauconitic marl, forming lowest calcareous unit in quarry; sample taken 6–10 inches below over-lying 4–5 foot very light gray indurated limestone. Collector: D. L. Frizzell, September 3, 1957. (Station F–57–8.)

EOCENE, Jackson group.

Danville Landing shale. Duty, Catahoula Parish, Louisiana; bank of Ouachita River at Duty ferry landing, east of town and off Louisiana Highway 124; lower shell marl bed of formation exposed at low water level. Collectors: D. L. Frizzell, C K. Lamber, and W. C. Horton, November 24, 1960. (Stations F–60–A2; CKL–60–2.)

Moody's Branch marl. Riverside Park, Jackson, Mississippi (reassigned type locality); basal greensand of formation, with abundant disseminated fossil fragments, just above the blue clay of underlying Cockfield formation. Collectors: E. Adams and D. L. Frizzell, November 24, 1959. (Stations F–59–9, 10, 11.)

Montgomery Landing, Montgomery, Grant Parish, Louisiana; east bank of Red River, 500 to 1,000 yards downstream from ferry landing (locally known as Creole or "Creola" Bluff); light, extremely shelly marl. Collectors: D. L. Frizzell, C K. Lamber, and W. C. Horton, November 23–24, 1960. (Stations F–60–A1; CKL–60–1.)

Yazoo County, Mississippi; bank of Techeva Creek (also "Tesheva" on U.S.G.S. maps) at bridge on Mississippi Highway 433, just north of town of Midway, which is northward from Benton; blue to blue-gray marly sandstone containing shell debris. Collectors: D. L. Frizzell and A. R. Troell, Jr., July 31, 1960. (Station F–60–3.)

EOCENE, Wilcox group.

Bashi marl. Meridian, Lauderdale County, Mississippi; bank of drainage ditch on south side of "Bypass 80"; lenticular bed of non-indurated shell debris overlying a bed of conspicuous white sand. Collectors: D. L. Frizzell, November 28, 1959; D. L. Frizzell and A. R. Troell, Jr., August 2, 1960. Stations F–59–16; F–60–8.)

SYSTEMATIC DESCRIPTIONS

Order ANGUILLIFORMES

Family Congridae

Genus **Conger** Schaeffer, *sensu latissimo*

Except for *Conger? vetustus,* that may be congenerie with Recent species of the genus, the species here described are not believed to belong to the genus *Conger s.s.* of the living fauna. "*Conger*" (in quotes) is a form-genus, applied only provisionally, that will be revised when more becomes known of the otoliths of Recent anguilliform fishes.

"**Conger**" **brevior** (Koken).

(Figures 4 a–b, 10 a–d.)

Otolithus (Conger) brevior Koken, 1888, Deutsch. Geol. Ges., Zeitschr., Bd. 40, pp. 293–294, pl. 18, fig. 7.

O. (Conger) brevior (Koken). Posthumus, 1924, Foss. Cat., no. I, pars 24, p. 8.

Description. Sagitta medium size (maximum length observed, 7.1 mm.), somewhat ovate with pronounced angularity, moderately high (height/length ratios, 61 to 67 per cent), moderately inflated, greatest height slightly anterior to vertical midline. Dorsal margin rising from sharply rounded anterior margin in low asymmetrical arch, with greatest curvature in posterior portion; posterior margin sharply rounded to join broad asymmetrically arched ventral margin; greatest curvature of ventral margin near position of greatest height. Inner face moderately convex, smooth, with prominent sulcus but lacking area; sulcus undivided, separated from anterior by broad border, extending from about anterior fifth of sagitta to near posterior third; sulcus opens onto dorsal margin through ostial channel; ostial region slightly to moderately excavated, elongate, contiguous with caudal region and sometimes set off from it by faint constriction of sides, its anterior margin truncate; ostial channel considerably posterior to anterior margin of ostial region, moderately long, with subparallel sides, slightly flaring dorsally to open onto dorsal margin near position of greatest height; caudal region deeply excavated, with subparallel sides, slightly longer than ostial region on most specimens; crista superior faintly developed or absent;

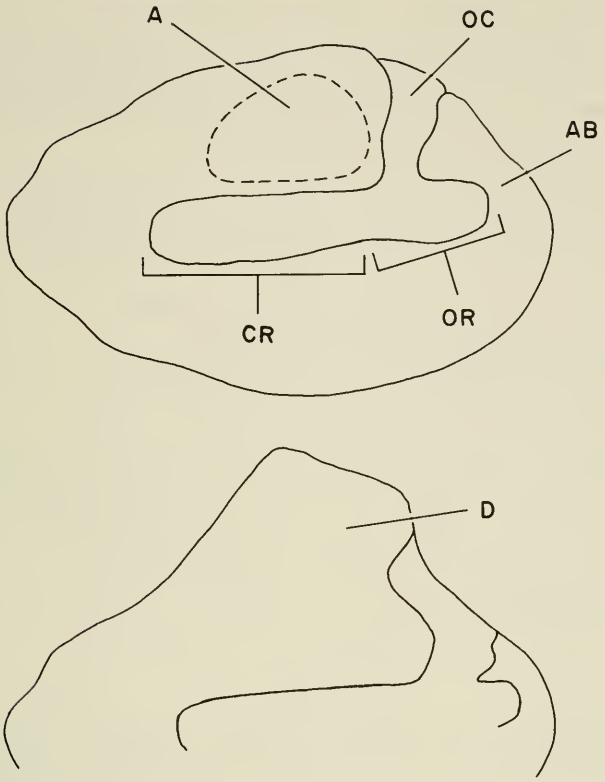

Figure A. Structures of the congrid type sagitta. A–area; AB–anterior border; CR–caudal region of sulcus; D–dorsal dome; OC–ostial channel; OR–ostial region.

crista inferior moderately marked, region above sulcus convex, lacking area. Outer face somewhat convex, flattened in central region, sculptured with weak undulations especially in marginal regions. Dimensions (in mm.):

Length	*Height*	*Thickness*
2.5	1.6	0.6
3.3	2.1	0.8
4.4	2.9	1.3
4.7	3.0	1.4
4.9	3.3	1.3
5.3	3.6	1.6
5.4	3.3	1.3
5.4	3.4	1.3
5.5	3.7	1.4
6.3	4.2	2.1

Comparisons of sagittae. *"Conger" brevior* is very similar to *"C." sanctus*, new species, that occurs with it in the Oligocene but not in the upper Eocene. *"Conger" brevior*, however, is less evenly ovate or elliptical and has no area. Distinction of these species must be based on comparison of suites of specimens, unless they are perfectly preserved.

The species differs from *"C" dissimilis*, new species, in the less nearly ovate outline and the projection of the ostial region forward of the ostial channel. The position of the ostial channel also distinguishes *"C." meridies*, new species.

A number of species related to *"C" brevior* have been described from Tertiary deposits of other areas, under the names *Conger, "Otolithus (Brotulidarum)," "O. (Congeris)," "O. (Congridarum)," "O. (incertae sedis)," Heterenchelys,* and *Uroconger*. The relationship of most of these to *"C." brevior* cannot be established without comparison of specimens with suleus and ostial channel perfectly preserved. For example, Priem compared *"O. (Congeris)" papointi* (1906, pp. 275–276, text figs. 40–45) and later *"O. (Congeris)" duvergieri* (1914, pp. 249–250, text fig. 9) with *"C." brevior*. Neither comparison is valid, as Priem's illustrations are of eroded specimens and Koken's type figure is completely inadequate.

Type locality. Eocene, Jackson group, Moody's Branch marl; Jackson, Mississippi.

Range and distribution. Oligocene, Vicksburg group: Byram marl, Old Byram and Vicksburgh, Mississippi; Glendon limestone, Brandon, Mississippi; Mint Spring marl, Vicksburg, Mississippi; Red Bluff clay, Hiwannee, Mississippi, and equivalent strata at St. Stephens, Alabama. Eocene, Jackson group: Moody's Branch marl, Montgomery, Louisiana, and near Midway, Mississippi.

Remarks. The type figure shows an immature specimen that could belong to this population or to that of *"C." sanctus*, new species. It is specifically unidentifiable. We are applying the name *"C." brevior* to this form, as

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Figure 1. *"Conger" sanctus* Frizzell and Lamber, new species, holotype; Vicksburg group, Alabama; length, 9.0 mm. 1a. Inner face of right sagitta. 1b. Outer face.

Figure 2. *"Conger" meridies* Frizzell and Lamber, new species, holotype; Wilcox group, Mississippi; length, 4.3 mm. 2a. Inner face of right sagitta. 2b. Outer face.

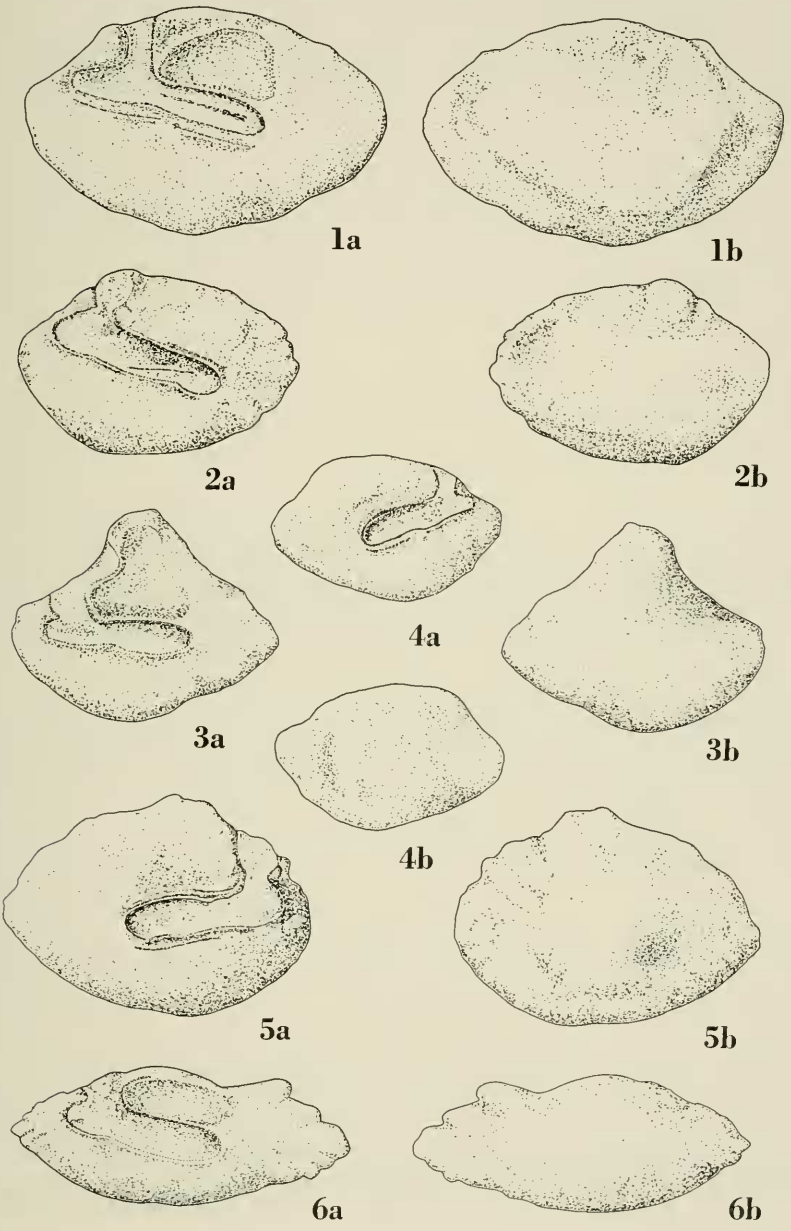
Figure 3. *"Conger" fornicatus* Frizzell and Lamber, new species, holotype; Jackson group, Louisiana; length, 3.6 mm. 3a. Inner face of right sagitta. 3b. Outer face.

Figure 4. *"Conger" brevior* (Koken); Vicksburg group, Mississippi; length, 5.5 mm. 4a. Inner face of left sagitta. 4b. Outer face.

Figure 5. *"Conger" dissimilis* Frizzell and Lamber, new species, holotype; Jackson group, Louisiana; length, 4.5 mm. 5a. Inner face of left sagitta. 5b. Outer face.

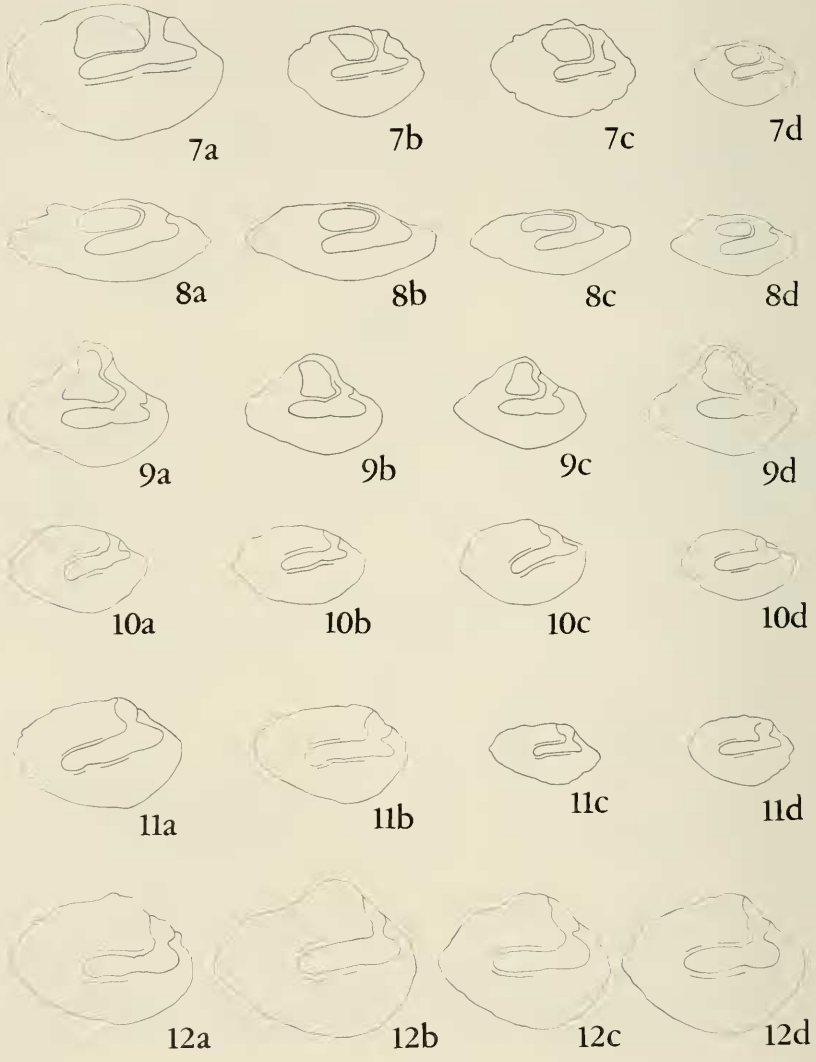
Figure 6. *Conger? vetustus* Frizzell and Lamber, new species, holotype; Jackson group, Louisiana; length, 4.4 mm. 6a. Inner face of right sagitta. 6b. Outer face.

"*C.*" *sanctus* has not been identified at the type level of the nominal species. Details of the sulcus, as shown by Koken, are due to erosion of the anterior boundary of the ostial channel. The horizontal position of the sulcus, in his figure, is believed to be an error of the artist.



"Conger" dissimilis Frizzell and Lamber, new species.
(FIGURES 5 a–b, 12 a–d.)

DESCRIPTION. Sagitta small to medium size (maximum length observed, 6.8 mm.), somewhat ovate in outline, high (height/length ratios, 71 to 80 per cent), moderately inflated, greatest height near anterior third of sagitta. Dorsal margin rising from rounded anterior margin in undulating high arch (or small dome) to meet sharply rounded posterior margin; ventral margin broadly and asymmetrically arched with greatest curvature coincident with



position of greatest height. Inner face moderately convex, smooth, with prominent sulcus and sometimes slightly developed area; sulcus undivided, separated from anterior by narrow border, extending from near anterior eighth of sagitta to near posterior third; sulcus opens onto dorsal margin through ostial channel; ostial region slightly excavated, contiguous with caudal region and sometimes set off from it by slight constriction of sides, its anterior margin rounded; ostial channel slightly posterior to anterior margin of ostial region, short to medium long, with nearly vertical sides, moderately flaring dorsally to open onto dorsal margin anterior to position of greatest height; caudal region moderately to deeply excavated with subparallel sides, of about same length as ostial region; cristae inferior and superior well marked; area slightly to very slightly impressed, somewhat triangular, extending upward into dorsal arch or dome. Outer face moderately convex, thickest at center, with poorly developed rugosities and pustules toward margins. Dimensions of holotype and selected paratypes (in mm.):

Figures 7–12. Diagrammatic sketches of inner face.

Figure 7. "*Conger*" *sanctus* Frizzell and Lamber, new species; holotype and paratypes. 1a. Holotype, reversed; Vicksburg group, Alabama; length, 9.0 mm. 1b. Reversed; Vicksburg group, Mississippi; length, 5.6 mm. 1c. Vicksburg group, Mississippi; length, 6.0 mm. 1d. Vicksburg group, Alabama; length, 4.2 mm.

Figure 8. *Conger? vetustus* Frizzell and Lamber, new species; holotype and paratypes. 8a. Holotype, reversed; Jackson group, Mississippi; length, 4.4 mm. 8b. Reversed; Jackson group, Louisiana; length, 4.2 mm. 8c. Reversed; Jackson group, Louisiana; length, 3.6 mm. 8d. Reversed; Jackson group, Louisiana; length, 2.8 mm.

Figure 9. "*Conger*" *fornicatus* Frizzell and Lamber, new species; holotype and paratypes; Jackson group, Louisiana. 9a. Holotype, reversed; length, 3.6 mm. 9b. Reversed; length, 3.0 mm. 9c. Reversed; length, 2.8 mm. 9d. Reversed; length, 3.1 mm.

Figure. 10. "*Conger*" *brevior* (Koken); Vicksburg group, Mississippi. 10a. Same as figure 4; length 5.5 mm. 10b. Length, 5.4 mm. 10c. Length, 5.3 mm. 10d. Reversed; length, 4.7 mm.

Figure 11. "*Conger*" *meridies* Frizzell and Lamber, new species; holotype and paratypes. Wilcox group, Mississippi. 11a. Holotype, reversed; length, 4.3 mm. 11b. Reversed; length, 3.6 mm. 11c. Length, 2.7 mm. 11d. Length, 2.5 mm.

Figure 12. "*Conger*" *dissimilis* Frizzell and Lamber, new species; holotype and paratypes; Jackson group, Louisiana. 12a. Holotype; length, 4.5 mm. 12b. Length, 5.3 mm. 12c. Reversed; length, 4.6 mm. 12d. Reversed; length, 4.3 mm.

Length	*Height*	*Thickness*	*Remarks*
2.6	1.9	0.9	
3.8	2.9	1.1	
3.8	3.0	0.9	
4.3	3.4	1.3	
4.4	3.5	1.3	
4.5	3.4	1.3	Holotype
4.6	3.6	1.5	
5.2	4.0	1.5	
5.8	4.1	1.7	
6.8	5.0	1.5	

Comparisons of sagittae. "*Conger*" *dissimilis* differs from "*C.*" *brevior* (Koken) and "*C.*" *sanctus,* new species, by its higher outline, greater convexity, and in lacking a marked anterior projection of the ostial region beyond the ostial channel. It is separated from "*C.*" *meridies,* new species, by its greater relative height and angularity in outline. As with "*C.*" *brevior* (see above), comparison with described extra-American forms is unprofitable at this time.

Type locality. Eocene, Jackson group, Moody's Branch marl; Montgomery ferry landing, Montgomery, Louisiana.

Range and distribution. The species is known only from the type locality.

Remarks. The specific name is a Latin adjective indicating the lack of similarity of this form to the sagittae of associated species.

"**Conger**" **fornicatus** Frizzell and Lamber, new species.
(Figures 3 a–b, 9 a–d.)

Description. Sagitta small (maximum length observed, 3.6 mm.), somewhat triangular in outline, very high (height/length ratios, 77 to 88 per cent), slightly inflated, greatest height at or forward of vertical midline. Dorsal margin rising from acutely rounded anterior margin in slightly incurved arch to form high dorsal dome, then descending in slightly incurved arch to join sharply rounded posterior margin; dorsal dome highly developed, somewhat quadrate, with bevelled top sloping toward anterior margin; ventral margin broadly arched, with greatest curvature slightly forward of position of greatest height. Inner face almost flat, smooth, with prominently developed sulcus and area; sulcus undivided, separated from anterior by moderately broad border, extending from about anterior sixth to posterior third of sagitta; sulcus opens onto dorsal margin through ostial channel; ostial region slightly excavated, short, contiguous with caudal region and usually set off by slight constriction (on well preserved specimens), its anterior margin truncate; ostial channel slightly posterior to anterior margin of ostial region, moderately long; anterior boundary of ostial channel nearly

straight, bending forward at termination, posterior boundary bending backward and upward; caudal region deeply excavated, with subparallel sides, longer than ostial region; cristae superior and inferior well developed, with crista superior following configuration of posterior boundary of ostial channel; area very prominent, deeply impressed, variable in outline (usually somewhat triangular), extending high into dorsal dome. Outer face smooth, slightly to moderately convex, thickest at center and in region of dorsal dome. Dimensions of holotype and selected paratypes (in mm.):

Length	*Height*	*Thickness*	*Remarks*
1.9	1.6	0.5	
2.0	1.6	0.5	
2.7	2.1	0.6	
2.7	2.4	0.7	
2.8	2.0	0.7	
3.0	2.1	0.8	
3.0	2.3	0.8	
3.1	2.4	0.8	
3.6	2.7	1.0	
3.6	2.8	0.9	Holotype

Comparisons of sagittae. "*Conger*" *fornicatus* is distinguished by its characteristic outline from all other forms known to us, including those illustrated in available literature.

Type locality. Eocene, Jackson group, Danville Landing shale (lower shell marl bed), Duty ferry landing, Duty, Louisiana.

Range and distribution. The species is known only from the type locality.

Remarks. The specific name *fornicatus* is a Latin adjective indicating the arched appearance of the sagitta produced by the development of the dorsal dome.

"**Conger**" **meridies** Frizzell and Lamber, new species.
(Figures 2 a–b, 11 a–d.)

Description. Sagitta medium small to medium size (maximum length observed, 6.7 mm.), somewhat ovate with pronounced angularity, moderately high (height/length ratios, 59 to 73 per cent), slightly to moderately inflated, greatest height at or anterior to vertical midline. Dorsal margin rising from sharply rounded anterior margin in moderately asymmetrical arch with greatest curvature at position of greatest height; posterior margin rounded with development of rugosities, joining broadly and asymmetrically arched ventral margin with greatest curvature at position of maximum height. Inner face smooth, slightly convex, with prominent sulcus but lacking area; sulcus

undivided, separated from anterior by very narrow border, extending from about anterior tenth to near posterior third of sagitta; sulcus opens onto dorsal margin through ostial channel; ostial region moderately excavated, short, contiguous with caudal region and sometimes set off from it by slight constriction of sides, its anterior margin rounded; ostial channel slightly posterior to anterior margin of ostial region, moderately long, directed upward and slightly backward, expanding in central region before constricting somewhat and opening onto dorsal margin at position of greatest height; caudal region longer than ostial, deeply excavated, with subparallel sides, expanding and rounded at posterior end; crista superior well marked, intensifying outline of sulcus; crista inferior slightly less developed; area absent. Outer face moderately convex on most specimens, thickest at center, with undulating surface along margins. Dimensions of holotype and selected paratypes (in mm.):

Length	*Height*	*Thickness*	*Remarks*
2.5	1.7	1.1	
2.7	1.6	1.0	
3.3	2.0	0.9	
3.3	2.1	0.9	
3.6	2.4	0.9	
3.6	2.6	1.1	
3.8	2.8	1.1	
4.3	2.8	1.1	Holotype
4.3	2.9	0.9	
4.8	3.2	1.0	

COMPARISON OF SAGITTAE. *"Conger" meridies* is lower, less convex, and less angular in outline than *"C." dissimilis,* new species. It somewhat resembles *"C." brevior* (Koken) and *"C." sanctus,* new species. Those, however, are distinguished by an anterior prolongation of the ostial region of the sulcus, forward of the ostial channel, that is much less developed in *"C." meridies.* As with *"C." brevior* (see above), similarities to extra-American forms cannot be determined at this time.

TYPE LOCALITY. Eocene, Wilcox group, Bashi marl; Meridian, Mississippi.

RANGE AND DISTRIBUTION. *"Conger" meridies* is known only from uncommon otoliths at its type locality.

REMARKS. The specific name, the Latin word for a geographic meridian, is in recognition of the type locality of the species: Meridian, Mississippi. It is a noun in apposition.

"Conger" sanctus Frizzell and Lamber, new species.
(FIGURES 1 a–b, 7 a–d.)

DESCRIPTION. Sagitta moderately large (maximum length observed, 9.0 mm.), somewhat ovate in outline, moderately high (height/length ratios, 62 to 72 per cent), moderately inflated, greatest height variable in relation to position of vertical midline. Dorsal margin rising from sharply rounded anterior margin in low nearly symmetrical arch; posterior margin moderately rounded to join arched ventral margin. Inner face moderately convex, smooth, with prominent sulcus and shallow area; sulcus undivided, separated from anterior by narrow border, extending from about anterior eighth of sagitta to near posterior third; sulcus opens onto dorsal margin through ostial channel; ostial region slightly excavated, elongate, contiguous with caudal region and sometimes set off by slight constriction of its sides, its anterior margin truncate; ostial channel very much posterior to anterior margin of ostial region, moderately long to long, with subparallel sides, slightly flaring dorsally to open onto dorsal margin slightly anterior to position of greatest height; caudal region deeply excavated, as long as ostial region, with nearly parallel sides; crista superior marked above caudal region, degenerate along ostial region; crista inferior well marked; area variable in outline and size (predominantly elliptical), slightly to moderately impressed. Outer face slightly to moderately convex, flattened in central region; sculpture lacking or consisting of irregular undulations or bosses adjacent to margins. Dimensions of holotype and selected paratypes (in mm.):

Length	*Height*	*Thickness*	*Remarks*
2.5	1.8	0.8	
3.3	2.1	0.8	
4.2	2.7	0.9	
4.8	3.1	1.1	
5.6	3.8	1.2	
5.7	3.6	1.3	
6.0	4.1	1.4	
6.1	4.0	1.5	
9.0	5.6	2.3	Holotype

COMPARISONS OF SAGITTAE. "*Conger*" *sanctus* is extremely like "*C.*" *brevior* (Koken), but is distinguished by the presence of an area and by the slight difference in outline. "*Conger*" *meridies*, new species, and "*C.*" *dissimilis*, new species, also lack the area and differ in outline, as well as having less well developed projection of the ostial region anterior to the ostial channel.

As with "*C.*" *brevior* (Koken) (see above), similarities to extra-American forms cannot adequately be determined from the literature. One species from the European upper Oligocene ("*C.*" *fallax* (Koken), 1891, p. 139, pl. 10, fig. 3; as *Otolithus (incertae sedis)*), however, appears to be extremely similar to "*C.*" *sanctus*, and the two may prove to be identical.

TYPE LOCALITY. Oligocene, Vicksburg group, Red Bluff clay equivalent; St. Stephens Quarry, St. Stephens, Alabama.

RANGE AND DISTRIBUTION. Oligocene, Vicksburg group: Glendon limestone, Brandon, Mississippi; Red Bluff clay, Hiwannee, Mississippi; Red Bluff clay equivalent, St. Stephens, Alabama.

REMARKS. The specific name *sanctus* (Latin for "sacred") refers to the type locality at St. Stephens Quarry. It is an adjective.

Conger? vetustus Frizzell and Lamber, new species.
(FIGURES 6 a–b, 8 a–d.)

DESCRIPTION. Sagitta small to medium large (maximum length observed, 4.8 mm.; one broken specimen has an estimated length of 7.3 mm.), sublanceolate, low (height/length ratios, 40 to 50 per cent), moderately inflated, greatest height at or slightly anterior to vertical midline. Dorsal margin rising from acute anterior margin in low arch; posterodorsal slope with one or more pronounced coarse rugosities (in well preserved specimens) before meeting acute posterior margin; ventral margin broadly arched. Inner face moderately convex, smooth, with prominent sulcus and area; sulcus undivided, separated from anterior by moderately broad border, extending from about anterior fifth to posterior third; sulcus opens onto dorsal margin through ostial channel; ostial region prominently excavated, short, contiguous with caudal region and sometimes set off from it by constriction of sides, its anterior margin rounded; ostial channel slightly posterior to anterior margin of ostial region, short and very wide; anterior boundary of ostial channel nearly straight, bent forward at termination, posterior boundary extending far backward near dorsal margin; caudal region deeply excavated, with subparallel sides, more than twice length of ostial region; crista superior well marked, bending to follow configuration of posterior boundary of ostial channel; crista inferior marked, especially below caudal region; area deeply impressed, predominantly elongate-elliptical. Outer face smooth, moderately convex, thickest along horizontal midline. Dimensions of holotype and selected paratypes (in mm.):

Length	*Height*	*Thickness*	*Remarks*
2.5	1.1	0.6	
2.6	1.2	0.6	
2.8	1.4	0.7	
3.0	1.2	0.6	
3.6	1.5	0.6	
4.2	1.8	0.7	
4.4	1.8	0.7	Holotype
4.7	1.9	0.7	

Comparisons of sagittae. *Conger? vetustus* is unlike other forms yet encountered in the American lower Tertiary. The sagitta resembles that of *Conger conger* (Linnaeus) of the Recent (Chaine, 1938, pp. 234–241, pl. 17). It differs from the adult sagitta of *C. conger* in having a shorter, narrower, better defined, and more sloping sulcus, and the anterior end is more sharply rounded. The sagitta of *C.? vetustus,* however, is extremely similar to that of juvenile *C. conger* as figured by Chaine.

Type locality. Eocene, Jackson group, Moody's Branch marl; Riverside Park, Jackson, Mississippi.

Range and distribution. The species is known from the Moody's Branch marl of Jackson, Mississippi, and Montgomery, Louisiana. It is rare at both localities.

Remarks. The similarity of *C? vetustus* to otoliths of young *Conger conger* (see above) may have some phylogenetic significance. It suggests that *C.? vetustus* belongs to a lineage that is ancestral to living species of *Conger s.s.*

The specific name is a Latin adjective meaning ancient.

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